

Notice of Allowability

Application No.

10/052,952

Examiner

Jerry T Rahll

Applicant(s)

FORBES ET AL.

Art Unit

2874

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Applicant's application received 17 January 2002.
2. ☒ The allowed claim(s) is/are 1-49.
3. ☒ The drawings filed on 17 January 2002 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

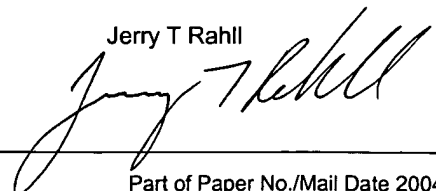
5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 20031101
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 20040201
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.


AKM ENAYET ULLAH
PRIMARY EXAMINER

Jerry T Rahll



EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with Viet Tong on 26 February 2004.
3. The application has been amended as follows (bold added for emphasis):
4. In Claim 1, "...forming a first channel in the first 3D photonic crystal region; and interfacing the first and second 3D photonic crystal regions to form a 3D waveguide defined by the first channel and a portion of the second 3D photonic crystal region covering the first channel." is changed to "...forming a first **empty** channel in the first 3D photonic crystal region; and interfacing the first and second 3D photonic crystal regions to form a 3D waveguide defined by the first **empty** channel and a portion of the second 3D photonic crystal region covering the first **empty** channel."
5. Claim 6 is changed to read, "The method of claim 1, wherein the method includes forming a second **empty** channel in the second 3D photonic crystal region, and aligning the first **empty** channel with the second **empty** channel when interfacing the first and second 3D photonic crystals so that the 3-D waveguide is defined by the first and second **empty** channels."
6. Claim 7 is changed to read, "The method of claim 1, wherein the method includes forming the first **empty** channel to have a rectangular cross-section."

7. In Claim 8, "...wherein at least one of the 3D photonic crystal regions includes a channel that forms a waveguide upon said combining of the two 3D photonic crystal regions." is changed to "...wherein at least one of the 3D photonic crystal regions includes **an empty** channel that forms a waveguide upon said combining of the two 3D photonic crystal regions."

8. Claim 11 is changed to read, "The method of claim 8, wherein the method includes forming the **empty** channel to include a taper."

9. Claim 12 is changed to read, "The method of claim 8, wherein the method includes forming the **empty** channel to include a bend."

10. Claim 13 is changed to read, "The method of claim 8, wherein the method includes forming the periodic array of spherical voids from unit cells, and forming the **empty** channel be at least one unit cell in width and at least one unit cell in depth."

11. Claim 14 is changed to read, "The method of claim 8, wherein the method includes forming the **empty** channel by etching at least one of the two 3D photonic crystal regions."

12. In Claim 16, "...forming a first channel in the first 3D photonic crystal region; interfacing the first and second 3D photonic crystal regions to form a 3D waveguide defined by the first channel and a portion of the second 3D photonic crystal region covering the first channel; and introducing radiation into an input end of the 3D waveguide." is changed to, "...forming a first **empty** channel in the first 3D photonic crystal region; interfacing the first and second 3D photonic crystal regions to form a 3D waveguide defined by the first **empty** channel and a portion of the second 3D photonic crystal region covering the first **empty** channel; and introducing radiation into an input end of the 3D waveguide."

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13. In Claim 20, "... bandgap in each 3D photonic crystal region, wherein at least one of the 3D photonic crystal regions includes a channel that forms a waveguide upon said combining of the two 3D photonic crystal regions; and ..." is changed to, "...bandgap in each 3D photonic crystal region, wherein at least one of the 3D photonic crystal regions includes **an empty** channel that forms a waveguide upon said combining of the two 3D photonic crystal regions; and ..."

14. Claim 23 is changed to, "A method of forming a 3D photonic crystal waveguide, comprising: forming first and second substantially identical 3D photonic crystal regions, wherein at least one of the regions includes **an empty** channel, and combining the first and second 3D photonic crystal regions to form a single 3D photonic crystal region with a waveguide defined by the **empty** channel, the single 3D photonic crystal having a complete photonic bandgap defined by first and second periodic arrays of voids formed in each of the first and second 3D photonic crystal regions."

15. In Claim 30, "...a channel passing through the single 3D photonic crystal region sized to receive and guide radiation of a wavelength corresponding to the complete photonic bandgap." is changed to, "...**an empty** channel passing through the single 3D photonic crystal region sized to receive and guide radiation of a wavelength corresponding to the complete photonic bandgap."

16. Claim 33 is changed to, "The waveguide structure of claim 30, wherein the **empty** channel includes a bend."

17. Claim 34 is changed to, "The waveguide structure of claim 30, wherein the **empty** channel includes a taper."

18. Claim 35 is changed to, "A waveguide structure, comprising: a 3D photonic crystal including a periodic array of voids formed in a solid substrate so as to have a complete photonic

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bandgap; and **an empty** channel waveguide formed in the 3D photonic crystal and sized to transmit light of a wavelength corresponding to the complete photonic bandgap.”

19. Claim 39 is changed to, “The waveguide structure of claim 35, wherein the **empty** channel waveguide has a bend.”

20. Claim 40 is changed to, “The waveguide structure of claim 35, wherein the **empty** channel waveguide has a rectangular cross-section.”

21. Claim 41 is changed to, “The waveguide structure of claim 35, wherein the **empty** channel waveguide includes a taper.”

22. Claim 44 is changed to, “A waveguide optical system comprising: a 3D photonic crystal comprising a periodic array of voids formed in a solid substrate so as to have a complete photonic bandgap; **an empty** channel waveguide formed in the 3D photonic crystal and sized to transmit light of a wavelength corresponding to the complete photonic bandgap; and a radiation source operatively coupled to a first end of the **empty** channel waveguide to provide radiation to be transmitted down the waveguide.”

23. Claim 46 is changed to, “The waveguide optical system of claim 44, further including a photodetector operatively coupled to a second end of the **empty** channel waveguide to detect radiation transmitted down the **empty** channel waveguide and generate an electrical signal in response thereto.”

EXAMINER’S STATEMENT OF REASONS FOR ALLOWANCE

24. Claims 1-49 are allowed. Claims 1-49 describe a waveguide structure having a 3D photonic crystal including a periodic array of voids formed in a solid substrate to form a

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complete photonic bandgap and an empty channel waveguide formed in the 3D photonic crystal and sized to transmit light of a wavelength corresponding to the complete photonic bandgap.

25. U.S. Patent No. 6,542,682 to Cotteverte et al. describes a waveguide structure having a 3D photonic crystal including a periodic array of voids formed in a solid substrate to form a complete photonic bandgap and an channel waveguide formed in the 3D photonic crystal and sized to transmit light of a wavelength corresponding to the complete photonic bandgap.

Cotteverte et al. does not describe an empty channel formed in the 3D photonic crystal.

26. U.S. Patent No. 6,542,682 to Cotteverte et al. remains the closest prior art of record in this application. For the reasons stated above, however, Claims 1-49 herein are deemed to patentably distinguish over Cotteverte et al. and all other prior art of record.

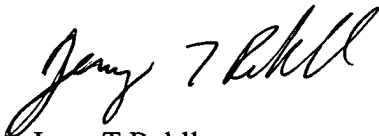
27. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jerry T Rahll whose telephone number is (571) 272-2356. The examiner can normally be reached on M-F (8:00-5:30), with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272-2344. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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